

## REMARKS

### INTRODUCTION

Claims 1-32 were previously and are currently pending and under consideration.

Claims 1-32 are rejected.

Claims 1, 6, 7, 10-12, 17, 18, 21-23 and 26 are amended herein.

No new matter is being presented, and approval and entry are respectfully requested.

### PRIOR ART: FALLON

Generally, in Fallon a location of a closest part is detected using an acoustic transducer and a video camera is directed to the detected location to capture an image of the closest part. The captured image is compared with a pre-stored image of the part to identify and locate the feature of the part.

More specifically, Fallon discusses a system for picking parts from a bin by locating a feature of the closest part. The robot is moved in a search pattern over the bin while a central acoustic transducer is used to locate the closest part. This gives a bearing from the robot toward the closest part. The video camera is aimed along the bearing at the part. A picture is taken of the part, and the picture is compared to a pre-stored image of the part for the purpose of locating a predetermined feature on the part. A second bearing, based on the feature in the image, is used to direct a laser beam at the feature. Reflection of the laser light is used to determine whether the feature has been correctly identified and located. When the laser confirms the location of the feature, a centroid of the part is calculated. A bearing from the robot arm to the centroid is determined. The robot arm is driven along the bearing to a predetermined distance from the centroid and stopped. An array of acoustic transducers then determines the tilt or aspect of the part. The acoustic signals are compared to pre-stored expected signal values at the predetermined distance from the part. A comparison or "error" between the expected and measured acoustic signals is used to drive the robot manipulator arm to a point where the part is grasped. As mentioned in Fallon, this "simplifies the identification of particular features on a part" (col. 2, lines 53-55).

The acoustic and image processing functions in Fallon are further summarized at column 7, lines 46-50: "The combination of an acoustic sensor array for bearing, distance, and aspect determination and a video camera for feature identification provides a simple approach for solving the bin picking problem." (emphasis added).

In sum, Fallon discusses only one pre-stored image of the part without any associated rotational posture information, and the image is used only to identify a bearing toward a feature on the part. The location (bearing and range) of the detected feature is only used to move the robot in the direction of the part, and an acoustic array is then used for pickup. Fallon does not disclose or suggest selecting or finding an object having an image matched with one of the reference models in the image data containing respective images of a plurality of objects.

#### **REJECTIONS UNDER 35 USC § 112, SECOND PARAGRAPH**

In the Office Action, at page 4, claim 26 was rejected under 35 U.S.C. § 112, second paragraph, for the reasons set forth therein. Appropriate correction has been made. Withdrawal of the rejection is respectfully requested.

#### **REJECTIONS UNDER 35 USC § 103**

In the Office Action, at pages 4-12, claims 1-4, 12-15, and 23-25 were rejected under 35 U.S.C. § 103 as being unpatentable over Iida in view of Fallon. Claims 5 and 16 were rejected as being obvious over Iida in view of Fallon and further in view of Suyama or Stauffer. Claims 6, 7, 11, 17, 18 and 22 were rejected as obvious over Iida in view of Fallon and further in view of Maeno. Claims 8, 19, 27 and 30 were rejected as obvious over Iida in view of Fallon in view of Maeno, and further in view of Soderberg. Claim 26 was rejected as obvious over Iida in view of Fallon and further in view of Soderberg. Claims 9, 10, 20, 21, 28, 29, 31, and 32 were rejected as obvious over Iida in view of Fallon in view of Maeno, and further in view of Sakakibara. These rejections are traversed and reconsideration is requested.

The specification discusses a model having rotational posture information. For example, at pages 12 and 13 the specification discusses a robot/camera at a capture direction (pointing at the reference model along the Z axis) capturing different images of different rotations/postures of

the reference model. For example, while pointing along the Z axis at the model, images and corresponding rotation/orientation posture information may be captured while the model (or robot) is rotated (e.g. spun) about the Z axis, for example at 30 degree increments. This can be repeated from different directions such as the X axis, and so on. Therefore, it is respectfully submitted that rotational posture orientation *of the part* is distinctly different than the combination's bearing type of orientation *toward the part* that is used as the direction for a translation or change of location.

The rejection interprets the "orientation" as a direction or bearing toward a part or model. This "orientation" is different than rotational posture type orientation. When considering a robot near a part to be picked up, two basic pieces of information can be desirable. First, a position (e.g., direction and range) of the robot relative to the part may be desirable. This is what is found in both Fallon and lida, where "position" refers to a location from which part-pickup can occur. However, there is also a second piece of information that can be useful; the orientation or rotational posture of the part relative to the robot. In Fallon, image data is not used to find such orientation, and rotational information of a part is found not by using lida's collative models but rather by *first* moving the already-grasped part to a fixed camera and *then* determining its rotational offset.

In lida, see Figure 17, where rotation (referred to therein as position) is determined in steps 502 and 504 after the part has been picked up at steps 402-406. Thus, lida does not use its collative models to determine orientation or rotational posture as discussed above. lida uses its collative models to find a location of a part and in particular a location of a pickup feature of the part. There may be some confusion because the locations in Fallon and lida are expressed therein in terms of an "orientation" and range, where orientation is a bearing or direction from the robot to the centroid or mark of the part. There may also be some confusion because lida refers to determining part "position" (steps 502 and 504) when post pickup rotation is actually what is being determined ("504 ... position correction ... is a deviation in the rotational direction and angle in the step 502", col. 12, lines 65-67).

It is respectfully submitted that the recited orientation in the present claims is not a locational or translational bearing *toward the part* as in Iida and Fallon (or their combination), but rather orientation is analogous to a rotational posture *of the part*. The claims have been amended only to clarify this interpretation of orientation, which was previously believed to be appropriate given that (1) orientation and position were both recited and therefore presumably not the same, and (2) models had a distinct capture direction.

Withdrawal of the rejection is respectfully requested.

Also, according to an aspect of the claims, there is a feature of explicitly selecting, by matching, one object of the plurality of objects, where the one object is to have an operation performed. The matching is performed on the image data of the plurality of objects containing respective images of the objects captured by the first image device with each of the reference models successively. Through the matching, one object having an image matched with one of the reference models is selected to be suitable for performing the robot operation thereon. Thus, the orientation, or orientation and position of the robot operation on the selected one object is determined based on the image of the selected object, the matched one reference model, the information of its associated capturing direction, and the information of the orientation of the robot operation with respect to the reference object that is associated with the one reference model. See page 18, line 20, to page 20, line 8, for further understanding.

In Iida, a plurality of collative models, each indicative of respective specific portions (e.g. parallel line segments or a circle) of parts having different configurations are stored, and data on corresponding line segments of the border line extracted from image data input from the camera 10 are collated with the collative models to find a target workpiece W and to determine a position of the corresponding specific portion. Iida, or Iida combined with Fallon, does not disclose or suggest performing matching on image data of the objects with the reference models created based on images of a reference object captured in a plurality of different directions so as to determine orientation (or orientation and position) of the object upon which the object operation is to be performed.

Furthermore, as discussed above, in Fallon, the location of the closest part in the plurality of parts is detected using the acoustic transducer, and then the video camera is directed to the detected location to capture an image of the closest part. The captured image is compared with a pre-stored image of the part to identify and locate the feature of the part. Fallon, or Fallon

combined with lida, does not disclose or suggest selecting or finding an object having an image matched with one of the reference models in the image data containing respective images of a plurality of objects.

Withdrawal of the rejection is further respectfully requested.

#### **DEPENDENT CLAIMS**

The dependent claims are deemed patentable due at least to their dependence from allowable independent claims. These claims are also patentable due to their recitation of independently distinguishing features. For example, claim 7 recites "said processor detects three-dimensional position and/or posture of the selected one object based on three-dimensional position of said characterizing portion obtained by said second image capturing device". This feature is not taught or suggested by the prior art. Withdrawal of the rejection of the dependent claims is respectfully requested.

#### **CONCLUSION**

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

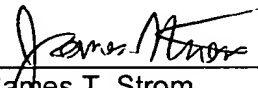
Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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Date: 26 July 2004

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